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Who Is Here?

- Parents
- SLP/s
- Teachers of the Deaf
- Audiologists *(you are excused!)*
- Cert. AVTs
- Classroom Teachers
- Other Educators
- Other Guests *(Grandparents? Physicians? Others?)*
FOUNDATION OF AUDITORY TEACHING
By using today’s incredible “sensory technology,” children with severe and profound hearing loss can and are making use of auditory information to develop spoken language – through listening!
The Options for “Success”…

Have *never* been more exciting!

**Why?**
- (Universal) Newborn Hearing Screening
  - Increased survival rates of “at risk” infants
- Increased focus on EARLY INTERVENTION & clinical efficacy
- Advances in sensory technology, most notably, **cochlear implants**!
The Sky’s the Limit!

**Why?**
- Early Identification
- Excellence in Audiology
- Sensory Technology
- Auditory Learning / Early Intervention
- Professional Certification of LSLS/s
Excellence in Audiology

The Foundation of Auditory-Based Intervention &
The KEY to auditory “success”
In order to have sound must have FORCE
In order to have *sound* must have MATTER
SOUND IS VIBRATION
Sources of Vibrations

- Tuning fork

What’s the force?
What’s the medium?
Sound is ...
Condensation and Rarefaction
Condensation

Rarefaction
Characteristics of Sinewave

- Amplitude
- Period
- Phase
- Frequency
FREQUENCY

- Number of cycles completed in 1 sec.
  (formerly referred to as cycles per second/cps)
- Expressed in Hertz (Hz)
- Psychophysical attribute is “PITCH”
- Inverse relationship with period

\[ f = \frac{1}{p} \]
AMPLITUDE

• Amount of displacement from baseline
• Psychophysical attribute is “LOUDNESS”
• Different measurements:
  – Peak (90 degrees)
  – Peak-to-peak (1 complete cycle)
  – Whole wave using RMS
• Expressed in decibels (dB)
Dynamic range of auditory system is:

$1 \text{ to } 100,000,000,000,000 \quad (10^{14})$
We use logs to the base 10

\[ 10 \log \left( \frac{10^{14}}{1} \right) = 10 \log \left( 10^{14} \right) \]
\[ = 10 \times 14 \]
\[ = 140 \text{ dB} \]
Decibels

• 1/10th of a Bel
• Named after Alexander Graham Bell
• But needs reference
dB is a dB is a dB is a dB
Decibels

- dB IL
  - Intensity level
  - $10^{-12}$ watts/m$^2$

- dB SPL
  - Sound pressure level
  - 20 µPa

- dB HL
  - Hearing Level

- dB SL
  - Sensation Level
Let’s talk about HEARING!
OHC movement to electrical stimulation
Let's take a look ….
UNHS

• Not all children are screened
• Some children are born at home – Train the midwives!
• U.S.: Need to screen non-documented family’s wee-ones
• Many U.S. programs only test with OAEs and likely miss ANSD (need 2-test models--ABR & OAE tests)
• Some hearing losses are progressive
• Disease processes occur in the first months of life
Audiologic Protocol

- Use a battery approach:
  - Auditory Brainstem Response (ABR) or Automated ABR (AABR)
  - Otoacoustic Emissions (OAEs)
  - Auditory Steady State Response (ASSR)
  - Behavioral Observation Audiometry (BOA)
  - Visual Reinforcement Audiometry (VRA)
  - Conditioned Play Audiometry (CPA)
OAEs
Tympanometry
Air Conduction Click ABRs
Bone Conduction Click ABR
Air Conduction Tonal ABRs
Click ABR
Air Conduction
Tonal ABRs
Behavioral Testing
Audiologic Recommendations

On-site audiology program with the early intervention program

Pediatric Test Assistant
(Birth to age 3-years-old)

Active parent participation

Comprehensive testing protocol
Audiograms

- Right Ear AC – Red circle
- Left Ear AC – Blue cross/x
- Right Ear BC – Red <
- Left Ear BC – Blue >
- A – “Aided” Threshold
- S – Soundfield Threshold (no ear specificity)
- PTA – Pure Tone Average (average of scores for RE or LE for 500, 1000, & 2000 Hz)
"Cheat Sheet" for Reading an Audigram

- **Right Ear**
  - Right is Red

- **Left Ear**

- This is your child's hearing WITHOUT hearing aids using air conduction testing (sound traveling through the air usually through headphones or ear inserts).

- This is your child's hearing WITHOUT hearing aids using bone conduction testing (sound vibrations traveling straight to the inner ear).

- The arrow pointing down indicates that at a given pitch (or frequency in Hz) when presented with the loudest level (or intensity in dB), no response or sound was heard.

- These are the symbols written when masking noise is used. The top symbols are for air conduction, the bottom symbols are for bone conduction.

- This is your child's hearing WITH their hearing aids (A) or cochlear implant(s) (C or CI or CI/CRI).

* This family reference, to be given to parents to make audigram information less complicated for them to understand, was created by Jennifer Rakers (2008), FIRST YEARS student. It was adopted from the FIRST YEARS reference document, "How to Read an Audigram: Auditory Thresholds," File http://firstyears.org/3/howreadad.htm.
Audiograms

Image from League for the Hard of Hearing
Audiogram “Configurations”

- Rarely are the thresholds “flat” across the audiogram / most often audiograms are “sloping” -- with the best responses in the LOW frequencies and typically the worst responses in the HIGH frequencies.
- Can show “RISING” configuration.
- Can show “Cookie Bite” configuration.
### Audiology Recommendations

<table>
<thead>
<tr>
<th>Unaided Testing</th>
<th>CI/HA Testing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Right Ear</td>
<td>CI-Only</td>
</tr>
<tr>
<td>Left Ear</td>
<td>CI &amp; HA</td>
</tr>
<tr>
<td>Aided Testing</td>
<td>HA-Only</td>
</tr>
<tr>
<td>Binaural</td>
<td>(if possible)</td>
</tr>
<tr>
<td>Right HA</td>
<td>Bilateral CIs</td>
</tr>
<tr>
<td>Left HA</td>
<td>Both CIs</td>
</tr>
</tbody>
</table>

- Right CI-Only
- Left CI-Only

**Because – every dB counts!**
Hearing Assistive Technology

Hearing Aids

Cochlear Implants

Other Implantable Devices

Hearing Assistive Technology

(especially FM/IR systems)
“Game Changer” – Cochler Implants

- Contour Advance Electrode X-ray
Hearing Technology Worn Throughout the Child’s Waking Hours (www.swimoutlet.com/www.poolrafts.com)
Consider Trying:

- www.hearinghenry.com
- #1 -- EAR GEAR — Spandex sleeve slips over hearing devices. Has stretch cord and plastic locking clip. www.gearforears.com
- Oto/Critter Clips www.westone.com
  - JoyBandsLLC.com
  - www.Silkawear.com
  - Ciwear.com
- Frogglez – “No Hazzle Swim Goggles www.thegromet.com
- www.hannaandersson.com (BEWARE!)
And one more recommendation:

Order a MedicAlert bracelet today!

**Suggested Wording:**

- Patient has hearing loss
- Patient uses hearing aids/cochlear implants (CI)
- NO MRI before talking to CI Center

www.medicalert.org
www.LaurensHope.com
“No Worries” – get slide!
We don’t expect anyone to become an audiologist!

However

Acoustics and basic knowledge of audiology is the foundation for auditory teaching!
The “New” AG Bell Association’s Knowledge Center
• “Recommended LSLS Protocol for Audiological Assessment & Cochlear Implant Monitoring”
  (AG Bell Academy, 2008; 2014)
ESSENTIAL KNOWLEDGE AREAS OF A LISTENING AND SPOKEN LANGUAGE SPECIALIST

- Hearing and Hearing Technology: 12%
- Auditory Functioning: 16%
- Spoken Language Communication: 16%
- Child Development: 9%
- Parent Guidance, Education, and Support: 13%
- Emergent Literacy: 6%
- Education: 6%
- History, Philosophy, and Professional Issues: 4%
- Strategies for Listening and Spoken Language Development: 18%
AG Bell Academy
LISTENING AND
SPOKEN LANGUAGE
SYMPOSIUM

The Brain Science of Hearing:
Connecting New Pathways to Spoken Language

JULY 9-11, 2015
Baltimore Marriott Waterfront
• **HEARING & AMPLIFICATION**

- Hearing Aid Choices

- Is My Baby a Candidate for a Cochlear Implant

Auditory Neuropathy Spectrum Disorder (ANSD)
HOPE Notes
(from Cochlear Americas by Nevins & Garber)

- Auditory Skill Development
- Spoken Language Development
- Assessment Measures
- Performance Outcomes
- The Newly Implanted Infant/Toddler
- The Newly Implanted Preschooler
- The Newly Implanted School-Age Child
- The Newly Implanted Teenager
- Amount and Type of Therapy
- Issues in Mainstreaming
- Issues in Reading
- Children Who Sign

- Children from Homes With Spoken Languages Other Than English
- The Experienced Cochlear Implant User: Preschool
- The Experienced Cochlear Implant User: School Aged and Teen
- Cochlear Implants and Special Populations
- Speech Development for Children With Cochlear Implants
- Vocabulary Development for Children With Cochlear Implants
USE the CI Manufacturers

- Websites
- Cochlear Ltd. / Cochlear Americas
- Listening Room – Advanced Bionics
- MED-EL – BRIDGE to Better Communication
It’s all about the BRAIN!
The ears are just the way in...
GOAL

AUDITORY ACCESS!
1-3-6 (U.S. Centers for Disease Control & Prevention)

1 Before **one** Month of Age:  
*Hearing Screening*

3 Before **three** Months of Age:  
*Hearing Evaluation*

6 Before **six** Months of Age:  
*Early Intervention*  
www.cdc.gov/ncbddd/ehdi